

FIG. 2

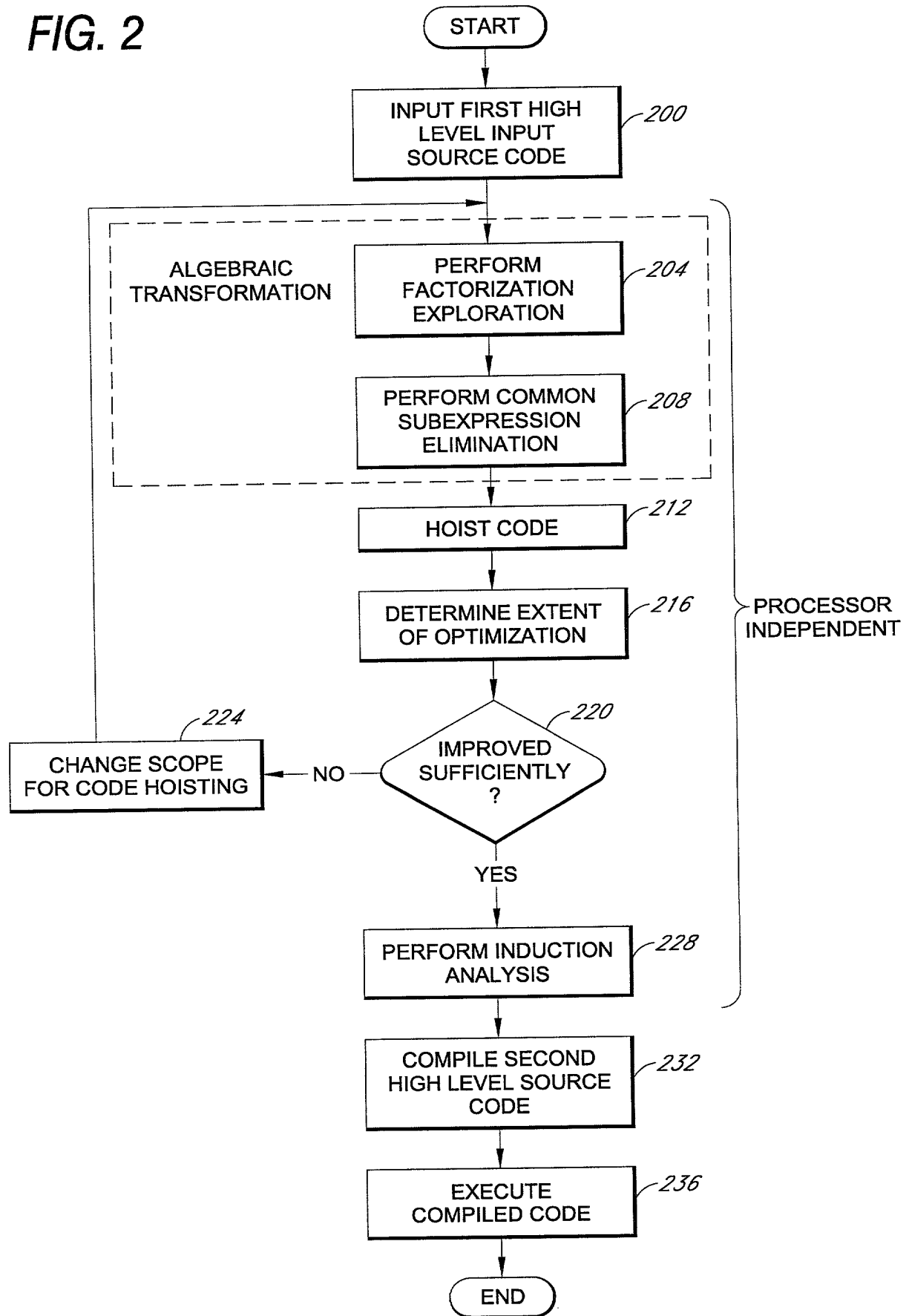


FIG. 3

```

for (y=0; y<M+3; ++y) {
  for (x=0; x<N+5; ++x) {
    ...
    if ((x-3)>=1 && (x-5)<=N-2 && (y-2)>=1 && (y-3)<=M-2) {
      if ((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          if (comp_edge_pixels [ ((x-4)%3)*3+ (y-2)%3 ] <comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels [ ((x-4)%3)*3+ (y-4)%3 ] <comp_edge_middle) out_compute=0;
          ...
          if (comp_edge_pixels [ ((x-5)%3)*3+ (y-4)%3 ] <comp_edge_middle) out_compute=0;
          ...
        }
      }
      if ((x-3)<=N-2 && (y-2)<= (M-2)) {
        maxdiff_compute =
          max13 (abs (gauss_xy_pixels [ ((x-2)%3)*3+ (y-1)%3 ]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13 (abs (gauss_xy_pixels [ ((x-2)%3)*3+ (y-3)%3 ]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13 (abs (gauss_xy_pixels [ ((x-3)%3)*3+ (y-3)%3 ]
            - gauss_xy_middle), maxdiff_compute);
        ...
      }
    }
    ...
  }
}

```

FIG. 4

```

for (y=0; y<M+3; ++y) {
  for (x=0; x<N+5; ++x) {
    ...
    if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
      if ((x-5)>=1 && (y-3)>=1) {
        if (out_compute == 255) {
          csexmin4mod3x3 = ((x-4)%3)*3;
          cseymin4mod3 = (y-4)%3;
          if (comp_edge_pixels [ csexmin4mod3x3 + (y-2)%3 ] <comp_edge_middle) out_compute=0;
          if (comp_edge_pixels [ csexmin4mod3x3 +cseymin4mod3 ] <comp_edge_middle) out_compute=0;
          if (comp_edge_pixels [ ((x-5)%3)*3 + (cseymin4mod3) <comp_edge_middle) out_compute=0;
          ...
        }
      }
      if ((x-3)<=N-2 && (y-2)<=(M-2)) {
        csexmin2mod3x3 = ((x-2)%3)*3;
        cseymod3 = y%3; /* = (y-3)%3 */
        maxdiff_compute =
          max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + (y-1)%3 ]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymod3 ]
            - gauss_xy_middle), maxdiff_compute);
        ...
        maxdiff_compute =
          max13 (abs (gauss_xy_pixels [ (x%3)*3 + cseymod3 ]
            - gauss_xy_middle), maxdiff_compute);
        ...
      }
    }
    ...
  }
}

```

distributivity : $(x + 4) \% 3 = (x \% 3 + 4 \% 3) \% 3$
 constant folding : $= (x \% 3 + 1) \% 3$
 constant unfolding : $= (x \% 3 + 1 \% 3) \% 3$
 invert distributivity : $= (x + 1_ \% 3$
 (a)

modulo expansion: $(x+2) \% 3 = 3 - x \% 3 - (x=1) \% 3$
 (b)

FIG. 5

```

for (y=0 ; y<M+3 ; ++y) {
    cseymod3 = y%3 ;
    cseymmin1mod3 = (y-1)%3 ;
    cseymmin2mod3 = (y-2)%3 ;
    cseymmin4mod3 = (y-4)%3 ;
    for (x=0 ; x<N+5 ; ++x) {
        ...
        if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
            if ((x-5)>=1 && (y-3)>=1) {
                if (out_compute == 255) {
                    cseymmin4mod3x3 = ((x-4)%3)*3 ;
                    if (comp_edge_pixels [ csexmin4mod3x3 + cseymmin2mod3 ] <comp_edge_middle) out_compute=0 ;
                    if (comp_edge_pixels [ csexmin4mod3x3 + cseymmin4mod3 ] <comp_edge_middle) out_compute=0 ;
                    if (comp_edge_pixels [ ((x-5)%3)*3 + cseymmin4mod3 ] <comp_edge_middle) out_compute=0 ;
                    ...
                }
            }
        }
        if ((x-3)<=N-2 && (y-2)<= (M-2)) {
            csexmin2mod3x3 = ((x-2)%3)*3 ;
            maxdiff_compute =
                max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymmin1mod3 ]
                    - gauss_xy_middle), maxdiff_compute) ;
            ...
            maxdiff_compute =
                max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymmod3 ]
                    - gauss_xy_middle), maxdiff_compute) ;
            ...
            maxdiff_compute =
                max13 (abs (gauss_xy_pixels [ (x%3)*3 + cseymmod3 ]
                    - gauss_xy_middle), maxdiff_compute) ;
            ...
        }
    }
}

```

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
    cseymin1mod3 = cseymod3;
    cseymod3 = y%3;
    cseymin2mod3 = 3-cseymod3-cseymin1mod3;
    for (x=0; x<N+5; ++x) {
        ...
        if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
            if ((x-5)>=1 && (y-3)>=1) {
                if (out_compute == 255) {
                    csexmin4mod3x3 = ((x-4)%3)*3;
                    if (comp_edge_pixels [ csexmin4mod3x3 + cseymin2mod3 ] <comp_edge_middle) out_compute=0;
                    if (comp_edge_pixels [ csexmin4mod3x3 +cseymin1mod3 ] <comp_edge_middle) out_compute=0;
                    if (comp_edge_pixels [ ((x-5)%3)*3 + (cseymin1mod3) <comp_edge_middle) out_compute=0;
                    ...
                }
            }
            if ((x-3)<=N-2 && (y-2)<= (M-2)) {
                csexmin2mod3x3 = ((x-2)%3)*3;
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymin1mod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ (x%3)*3 + cseymod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
            }
        }
        ...
    }
}

```

FIG. 7

FIG. 8

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
    cseymin1mod3 = cseymod3;
    cseymod3 = y%3;
    cseymin2mod3 = 3-cseymod3-cseymin1mod3;
    for (x=0; x<N+5; ++x) {
        ...
        if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
            csexmod3x3 = (x%3)*3;
            csexmin2mod3x3 = ((x-2)%3)*3;
            cseymin4mod3x3 = ((x-4)%3)*3;
            csexmin5mod3x3 = ((x-5)%3)*3;
            if ((x-5)>=1 && (y-3)>=1) {
                if (out_compute == 255) {
                    if (comp_edge_pixels [ csexmin4mod3x3 + cseymin2mod3 ] < comp_edge_middle) out_compute=0;
                    if (comp_edge_pixels [ csexmin4mod3x3 +cseymin1mod3 ] <comp_edge_middle) out_compute=0;
                    if (comp_edge_pixels [ csexmin5mod3x3 +cseymin1mod3 ] <comp_edge_middle) out_compute=0;
                }
            }
        }
        if ((x-3)<=N-2 && (y-2)<= (M-2) ) {
            maxdiff_compute =
                max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymin1mod3 ]
                    - gauss_xy_middle), maxdiff_compute);
            ...
            maxdiff_compute =
                max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymod3 ]
                    - gauss_xy_middle), maxdiff_compute);
            ...
            maxdiff_compute =
                max13 (abs (gauss_xy_pixels [ csexmod3x3 + cseymod3 ]
                    - gauss_xy_middle), maxdiff_compute);
            ...
        }
    }
    ...
}

```


FIG. 9

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
    cseymin1mod3 = cseymod3;
    cseymod3 = y%3;
    cseymin2mod3 = 3-cseymod3-cseymin1mod3;
    for (x=0; x<N+5; ++x) {
        csexmod3x3 = (x%3)*3;
        csexmin2mod3x3 = ((x-2)%3)*3;
        cseymin4mod3x3 = ((x-4)%3)*3;
        csexmin5mod3x3 = ((x-5)%3)*3;
        ...
        if (x>=4 && x<=N+3 && y>=3 && y<=M+1) {
            if ((x-5)>=1 && (y-3)>=1) {
                if (out_compute == 255) {
                    if (comp_edge_pixels [ csexmin4mod3x3 + cseymin2mod3 ] <comp_edge_middle) out_compute=0;
                    if (comp_edge_pixels [ csexmin4mod3x3 +cseymin1mod3 ] <comp_edge_middle) out_compute=0;
                    if (comp_edge_pixels [ csexmin5mod3x3 +cseymin1mod3 ] <comp_edge_middle) out_compute=0;
                    ...
                }
            }
            if ((x-3)<=N-2 && (y-2)<= (M-2) ) {
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymin1mod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ csexmod3x3 + cseymod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
            }
        }
        ...
    }
}

```

FIG. 10

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
    cseymin1mod3 = cseymod3;
    cseymod3 = y%3;
    cseymin2mod3 = 3-cseymod3-cseymin1mod3;
    cseymod3x3 = -3;
    for (x=0; x<N+5; ++x) {
        csexmin1mod3x3 = cseymod3x3;
        csexmod3x3 = (x%3)*3;
        csexmin2mod3x3 = 9-csexmod3x3-csexmin1mod3x3;
        ...
        if (x>=4 && x<N+3 && y>=3 && y<=M+1) {
            if ((x-5)>=1 && (y-3)>=1) {
                if (out_compute == 255) {
                    if (comp_edge_pixels [ csexmin1mod3x3 + cseymin2mod3 ] <comp_edge_middle) out_compute=0;
                    if (comp_edge_pixels [ csexmin1mod3x3 +cseymin1mod3 ] <comp_edge_middle) out_compute=0;
                    if (comp_edge_pixels [ csexmin2mod3x3 +cseymin1mod3 ] <comp_edge_middle) out_compute=0;
                    ...
                }
            }
            if ((x-3)<=N-2 && (y-2)<= (M-2) ) {
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymin1mod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ csexmin2mod3x3 + cseymod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
                maxdiff_compute =
                    max13 (abs (gauss_xy_pixels [ csexmod3x3 + cseymod3 ]
                        - gauss_xy_middle), maxdiff_compute);
                ...
            }
        }
        ...
    }
}

```

FIG. 11

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
    cseymin1mod3 = cseymod3;
    cseymod3 = y%3;
    cseymin2mod3 = 3-cseymod3 - cseymin1mod3;
    csexmod3x3 = -3;
    cseymin1mod2 = (y-1)%2;
    cseymod2 = 1 - cseymin1mod2;
    for (x=0; x<N+5; ++x) {
        csexmin1mod3x3 = csexmod3x3;
        csexmod3x3 = (x%3)*3;
        csexmin2mod3x3 = 9-csexmod3x3 - csexmin1mod3x3;
        csexmin1x2 = (x-1)*2;
        csexmin3x2 = csexmin1x2-4;
        ...
        if (x>=3 && x<N+3 && y>=2 && y<=M+2)
            tmparray [ (csexmin3x2 + cseymod2) % 160
                      + (csexmin3x2 + cseymod2) / 160*256 + 96 ]
                = comp_edge_pixels [ csexmod3x3
                                   + cseymin2mod3 ] = maxdiff_compute;
        ...
        if (x>=1 && x<N+1 && y>=1 && y<=M)
            tmparray [ (csexmin1x2 + cseymin1mod2) % 64
                      + (csexmin1x2 + cseymin1mod2) / 64*256 ]
                = gauss_xy_pixels [ csexmin1mod3x3
                                   + cseymin1mod3 ] = gauss_xy_compute;
        ...
    }
}
}
}

```

FIG. 12

```

cseymod3 = -1;
for (y=0; y<M+3; ++y) {
    cseymmin1mod3 = cseymod3;
    cseymod3 ++;
    if (cseymod3 >= 3) { cseymod3 -= 3; }
    cseymmin2mod3 = 3-cseymod3 - cseymmin1mod3;
    cseymmin1mod2 = (y-1) & 1;
    cseymod2 = 1 - cseymmin1mod2;
    csexmmod3x3 = -3;
    csexx2mod160_1_2 = cseymod2 - 8;
    csexx2div160_1_2 = 0;
    for (x=0; x<N+5; ++x) {
        csexmmin1mod3x3 = csexmmod3x3;
        csexmmod3 ++;
        if (csexmmod3 >= 3) { csexmmod3 -= 3; }
        csexmmod3x3 = csexmmod3 * 3;
        csexmmin2mod3x3 = 9 - csexmmod3x3 - csexmmin1mod3x3;
        csexx2mod160_1_2 += 2;
        csexmmin1x2 = (x-1) * 2;
        csexmmin3x2 = csexmmin1x2 - 4;
        if (csexx2mod160_1_2 >= 160) { csexx2mod160_1_2 - = 160; csexx2div160_1_2 ++; }
        ...
        if (x>= 3 && x<N+3 && y>=2 && y<M+2)
            tmparray [ csexx2mod160_1_2 + csexx2div160_1_2 * 256 + 96 ]
                = comp_edge_pixels [ csexmmod3x3
                    + cseymmin2mod3 ] = maxdiff_compute;

        if (x>= 1 && x<N+1 && y>=1 && y<=M)
            tmparray [ (csexmmin1x2 + cseymmin1mod2) & 63)
                + ((csexmmin1x2 + cseymmin1mod2) > 6) * 256 ]
                = gauss_xy_pixels [ csexmmin1mod3x3
                    + cseymmin1mod3 ] = gauss_xy_compute;
        ...
    }
}
}
}

```

FIG. 13

